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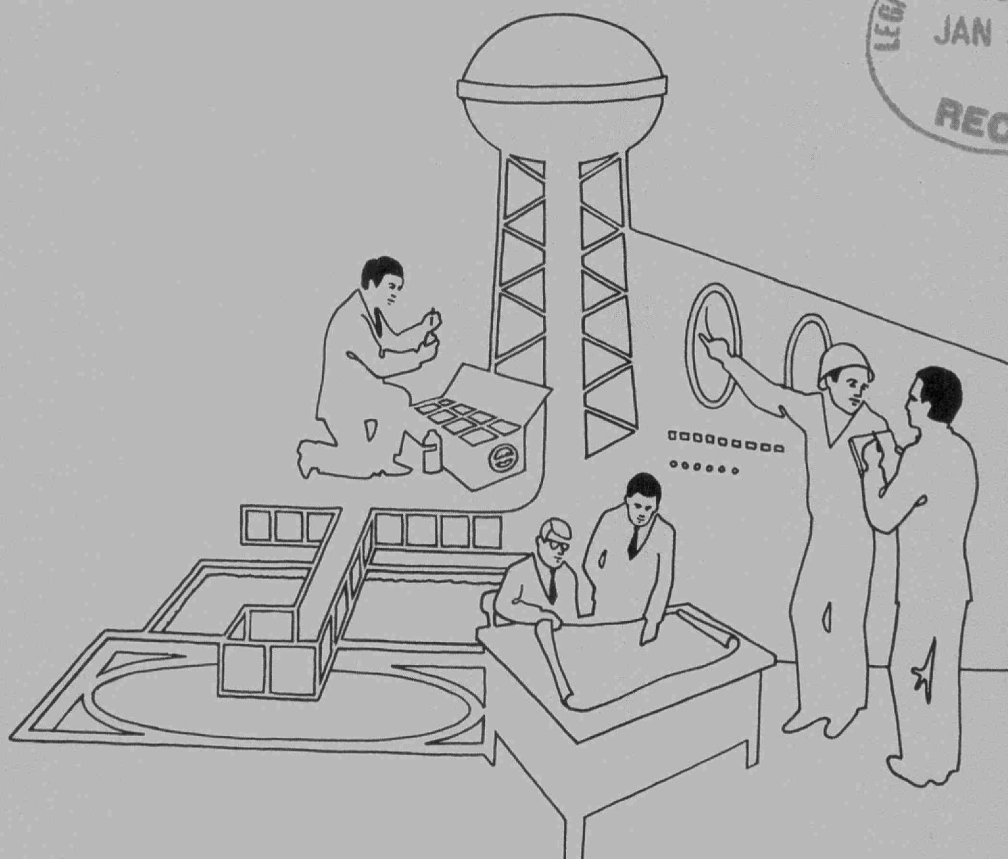

WATER POLLUTION SURVEY

of the

TOWN OF GRAVENHURST URBAN AREA

DISTRICT MUNICIPALITY OF MUSKOKA

1971

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I INTRODUCTION

A water pollution survey of the urban area of the Town of Gravenhurst was made during the summer months of 1971.

Surveys of this nature are carried out by the Ontario Water Resources Commission upon request or on a routine basis. The purpose of these surveys is to locate possible sources of water pollution and suggest what corrective measures should be taken in order to eliminate them. Follow-up investigations are usually conducted at some future date to determine if the recommendations have been implemented and the sources of pollution eliminated.

II SUMMARY AND CONCLUSIONS

The urban area of the town has a population of approximately 3,322 persons. It has a municipal water works system which services almost the entire population. This system has the capability of servicing approximately 2,000 additional persons excluding the Gull Lake supply. If the Gull Lake supply is included approximately 5,400 additional persons can be accommodated.

Domestic wastes from approximately 66% of the population are directed to a conventional activated sludge sewage treatment plant which has a rated hydraulic capacity of 450,000 gallons per day with the effluent being discharged to Muskoka Bay. The treatment plant is producing a satisfactory effluent from an organic and bacteriological standpoint and full-scale plant tests are presently being done to determine the appropriate treatment required to satisfactorily reduce the phosphorus input to Muskoka Bay. Since July 26 phosphorus input has been reduced by more than 80 per cent.

Based on present flows at this plant, there is a reserve hydraulic capacity of 157,400 gallons per day or a population equivalent of approximately 1,180 persons. A reserve organic capacity of about 400 pounds of BOD per day exists which based on present raw sewage concentrations

(which are lower than normally expected for domestic sewage), a reserve capacity for approximately 3,500 additional persons exists. If the normal concentration values are applied there is a population equivalent in reserve capacity of approximately 2,400 persons.

From the reserve capacities mentioned above, it should be noted that hydraulic capacity is the limiting factor. Therefore, it is suggested that a program for sewer separation along Muskoka Road as well as disconnection of roof drains and sump pump connections to the sanitary sewer system be initiated as soon as possible.

Although water pollution control and abatement appears to be relatively good in the Town of Gravenhurst, some problem areas exist. The main problems in the survey area are situated in the outer regions. These regions, are not serviced by sanitary sewers and thus pollution problems may be associated with inadequate private sewage disposal systems. This would indicate that sanitary sewering is of prime importance.

Accelerated algae growth in Muskoka Bay has become a problem in the past few years. In an attempt to correct this problem the Town of Gravenhurst and the Ontario Hospital authorities in conjunction with OWRC are at present conducting phosphorus removal tests at their respective sewage treatment plants and first results indicate greater

than 80% reductions are being achieved. The Town of Gravenhurst has pledged to have permanent phosphorus removal facilities installed as soon as possible and the Ontario Hospital will do likewise.

It is also concluded that the problem areas mentioned previously add to the nutrient load in the Bay, therefore strengthening the need for services in these areas.

Upon inspection the area around Pinedale Road and Crescent Drive appeared to be poorly drained. Since this area is the main problem area with respect to sump pump connections to sanitary sewers, it may be advantageous to conduct some drainage studies to see if storm sewers should be provided to receive sump pumpage or to drain the area and eliminate the need for sump pumps.

III RECOMMENDATIONS

From the results and conclusions of this report it is recommended that:

1. A sewer separation program along Muskoka Road should be initiated.
2. Roof drains connected to the sanitary sewer system should be severed.
3. A drainage study should be conducted in the Pinedale Road - Crescent Drive area to investigate better methods of relieving drainage problems other than pumping sumps to the sanitary sewer.
4. Sanitary sewers should be extended to include the non-serviced areas as soon as possible.
5. A study should be conducted to locate and stop sources of pollution to the creek adjacent to the sewage treatment plant.
6. The storm sewer discharging at David Street and Muskoka Road should be checked for possible sources of contamination.
7. Possible sources of animal waste contamination in the Musquash Road - Private Street area should be located and eliminated.
8. Reduction of enrichment of Muskoka Bay should be maintained as the prime priority.

IV GENERAL

The urban area of the Town of Gravenhurst is situated approximately 110 miles north of Toronto in the District Municipality of Muskoka. It is bounded on the east by Gull Lake and on the west by Muskoka Bay. The town has an assessed population of 5,955 persons (1971 Municipal Directory). However, the main urban area has a population of approximately 3,320 persons. It derives most of its income from tourism.

V WATER SUPPLY

The water used to service the urban area of the Town of Gravenhurst is obtained from Gull Lake and two drilled wells. Although the water from all three sources is of satisfactory quality from a health standpoint, it is necessary to treat the water for iron and corrosion control.

The Gull Lake supply which is the only supply that is chlorinated has a low pH value which causes copper pipe corrosion. As a result of tests performed by the Technical Advisory Services Branch of the Ontario Water Resources Commission, it was established that the addition of sodium bicarbonate to this water would control the pH and eliminate corrosive action.

The water obtained from both the Lorne and Nelson Street wells has a very high iron content. The iron is held in solution at the Nelson Street well by the addition of sodium silicate. This treatment was not sufficient at the Lorne Street well and therefore, additional tests were conducted by the OWRC. As a result of these tests, it was found that satisfactory iron control could be achieved with the addition of a sodium silicate and sodium hypochlorite solution. However, due to an oversized chemical feed pump used at this well, the proper mixing between the water and the above mentioned solution was not achieved.

This improper mixing may have caused the water to turn black when boiled. The problem; however, may be solved by the purchase of the proper feed pump thus allowing the well to be put into full service in the future.

The total pumping capacity of this system is 2.575 MGPD. This is compiled from the three supplies, namely, Gull Lake, Nelson Street well and Lorne Street well, with rated pumping capacities of 1.008 MGD, 0.575 MGPD and 1.0 MGPD, respectively. The system also has a 100,000 gallon elevated storage tank. It should be noted that the Gull Lake supply is used sparingly in the summer months due to the warm temperature of the water. The warm temperature does not create any problems at the present time due to the limited use of this supply but it may cause problems when the water usage approaches the capacity of the system.

The water pumpage records for 1969, 1970 and the first eight months of 1971 are appended to this survey (See Appendix I, II and III). A summary of these is as follows:

YEAR	AVERAGE DAY (Gal.)	MAXIMUM DAY (Gal.)	FOR FIRST 8 MONTHS AVERAGE DAY (Gal.)	POPULATION SERVED	PER CAPITA CONSUMPTION (Gal./Day)
1969	300,805	752,013	312,008	3,282**	92
1970	322,931	807,328	348,477	3,322**	97
1971	390,000*	975,000	410,142	3,322**	117

* See Flow Determination
** Populations obtained from appropriate Municipal Directory

The following table indicates the water usage during the last four months of 1969 and 1970 and is used in order to determine the average daily flow for 1971:

FLOW DETERMINATION

YEAR	TOTAL FLOW (gal.)	LAST 4 MONTHS OF YEAR Total Flow (gal.)	Year Percentage Total Flow
1969	109,794,000	34,012,000	31%
1970	117,870,000	34,115,000	29%

Therefore, if the flow for the last four months of each year is taken as 30% of the total year's flow, then it may be calculated that the total flow in 1971 will be 142,377,857 gallons or an average day flow of 390,000 gallons.

The maximum day flows as presented in the water flow summary and in Appendix I, II & III was calculated on the generally accepted assumption that the maximum day flows is 2.5 times the average day flow. Therefore, in 1971 the maximum day flow is estimated to be 975,000 gallons. Using this flow figure and a population of 3,320 persons, a maximum per capita consumption figure of 294 gallons per day is represented. Based on this figure an additional population including and excluding the Gull Lake supply of approximately 5,400 persons and 2,000 persons, respectively, may be serviced.

VI POLLUTION CONTROL

Sanitary Waste Disposal

1. Town of Gravenhurst

The study area of the Town of Gravenhurst is serviced by separate sewer systems except for one combined sewer located along Muskoka Road. The combined sewer serves the commercial section of the town. Approximately two-thirds of the urban area of the town which has a population of approximately 2,200 people, is served by the sewerage system. The remaining area, served by individual septic tank - tile bed systems, is located in the north, south and western limits of the urban area. At the present time plans are underway for a sanitary sewer extension to serve the southern area.

Storm water as indicated by the higher flows during spring runoff (Appendix IV, V, VI) is gaining access to the treatment plant. The majority of the storm water can be attributed to the combined sewer along Muskoka Road. It is believed that roof drains and sump pumps are also major contributors. It is reported that six commercial establishments on Muskoka Road plus Brown's Beverages and Muskoka Nursing

Home on Bay Street and Second Street, respectively, have roof drains connected to the sewer system. Until there is sewer separation along Muskoka Road little can be done to disconnect the six commercial establishments. The roof drains from Brown's Beverages and the Muskoka Nursing Home are connected to the sanitary sewerage system and should be disconnected as soon as possible.

Another contributing factor to increased storm water flow is individual homes with "sump pumps" connected to the sanitary sewerage system. The Gravenhurst Electric Light & Power Commission are attempting to locate and disconnect them; however, it is suspected that residents reconnect them after the inspection. Reportedly, the main problem area is in the vicinity of Pinedale Road and Crescent Drive. This area appears to be poorly drained and as a result residents use sump pumps in an attempt to keep their basements dry.

The domestic wastes from the sewered area of the town are directed to a conventional activated sludge treatment plant with a rated hydraulic capacity of 450,000 GPD in dry weather flow. This plant was designed to accommodate waste from 4,000 persons with an organic loading of 652 pounds of BOD per day.

This type of plant is capable of 90 per cent reduction in BOD and suspended solids.

The plant flow records for 1969, 1970 and the first eight months of 1971 are tabulated in Appendix IV, V & VI. A summary of these records is as follows:

YEAR	TOTAL FLOW (gal.)	AVERAGE DAY FLOW (gal.)	AVERAGE DAY FLOW (gal.) (first 8 months)	MAXIMUM DAY FLOW (gal.)	MINIMUM DAY FLOW (gal.)
1969	80,060,300	220,000	233,491	422,500	114,670
1970	69,712,000	191,000	189,173	452,000	109,000
1971*	71,101,800	-	292,600	629,000	105,900

* All figures obtained from first eight months of 1971

From the above summary it is noted that in 1969 and 1970 the average day flow for the year is approximately equal to the average daily flow for the first eight months of both years. Therefore, the figure listed for the first eight months of 1971 can be considered an accurate assessment of the average day flow for the year.

On the basis that the average day flow for 1971 is 292,600 gallons and a population of 2,200 persons is being served, the per capita flow is 133 gallons per day. With the reserve hydraulic capacity of 157,400 gallons, it is calculated that approximately

1,180 additional persons may be served by the sewage treatment plant before expansion is necessary.

From 24-hour composite sampling programs conducted by OWRC staff in 1970 and early 1971, it has been established that the average organic loading at the Gravenhurst plant is 250 pounds of BOD per day. With an estimate of 2,200 people contributing to the plant, the organic loading is 0.113 pounds of BOD per capita per day. Therefore with an organic load design of 652 pounds of BOD per day, the reserve organic capacity of 402 pounds of BOD could serve 3,560 people. It should be noted, however, that the per capita figure of 0.113 pounds of BOD per day is low compared to the general criteria of 0.17 pounds of BOD per capita per day.

The analysis results from samples taken from the Pollution Control Plant in 1969, 1970 and 1971 are tabulated in Appendix VII, VIII and IX. A summary of these results are as follows:

YEAR	RAW SEWAGE		FINAL EFFLUENT *		% REDUCTION	
	5-Day BOD	SS	5-Day BOD	SS	BOD	SS
1969	106*	151*	11*	15*	89.5	90
1970	134*	127*	19*	18*	86	86
1971	129*	193*	13.3*	13*	89.5	93

* Average of samples taken

From this summary it is calculated that the BOD and suspended solids reduction is generally satisfactory.

2. The Ontario Hospital

Domestic wastes from the Ontario Hospital and the Ontario Fire College are directed to an extended aeration sewage treatment plant with a rated hydraulic capacity of 70,000 gallons per day and an organic loading capacity of 226 lbs. of BOD per day. The results of 24-hour composite sampling of the raw sewage and final effluent at the plant indicate the following loadings:

DATE 1971	FLOW (gal.)	BOD LBS./DAY		PHOSPHORUS (LBS./DAY)	
		Raw	Final	Raw	Final
Jan. 25	70,000	161.1	7.4	5.46	3.69
Aug. 16	58,700	208.4	7.42	9.27	3.07
Aug. 17	58,000	127.8	7.97	5.36	4.54
Aug. 18	57,000	133.2	7.72	4.19	3.85

The sewage from the Ontario Fire College was directed to this plant in March, 1971. During the week of August 15 the Ontario Fire College was fully occupied. Since this system has little variance in population served the loadings as listed above for August 16, 17 and 18 can be considered to be representative of the maximum loadings at this plant. The decrease in flow from

January to August as seen above can be attributed to the partial shutdown of the laundry facilities at the Ontario Hospital. Since August, there has been a complete shutdown of the laundry and therefore plant flows and BOD loadings may be slightly lower than listed in the above table.

VII INDUSTRIAL WASTE DISPOSAL

Industries in the Town of Gravenhurst contribute little flow to the sanitary sewer system other than domestic waste. The major industries, Rubberset of Canada and Brown's Beverages, have little liquid industrial waste products. At the present time, there are a number of major commercial establishments in the built-up area with their own waste disposal systems. These establishments are as follows:

1. Briars Dairy Limited

This dairy disposes of milk wastes by means of the ridge and furrow irrigation and holding pond method. The wastes are discharged to a tilled field and any effluent flows to the holding pond located at the termination of this field. During the summer months the dairy is operating at peak production and upon inspection there was no ponding of wastes other than in the pond which had approximately one foot of liquid depth.

This method of operation was successful in the past according to reports by the Division of Industrial Wastes of the OWRC. It is therefore concluded that there are no water pollution problems associated with this system.

2. Walkers' Snack Bar and Marina

Disposal of sewage from this snack bar and marina is achieved by means of a septic tank and subsurface tile field. This system was reportedly dye tested by the Muskoka-Parry Sound Health Unit in the summer of 1970. The dye testing indicated that there were no noticeable water pollution problems associated with this system.

3. Others

A number of marinas border the southern shores of Muskoka Bay. These establishments are not serviced by a sewer system and operate on private septic tank - tile field systems or holding tanks. The adequacies of these systems are questionable and sanitary sewers would eliminate any existing or future problems.

VIII REFUSE DISPOSAL

The refuse from the Town of Gravenhurst and surrounding area is hauled to a disposal site off Muldrew Lake Road. This site is well isolated from the local watercourse and as a result no water impairment is suspected. The operation at this site consists of dumping the refuse over a high rock ridge into the valley and then burning the combustible materials. This operation is now under the jurisdiction of the Waste Management Branch of the Department of the Environment.

Also situated in this area is a dump for sludge from the Gravenhurst sewage treatment plant. During the inspection in May, it was noted that sludge was leaking out of the dump area. It was reported to the Gravenhurst Electric Light and Power Commission and upon a future inspection the problem had been corrected. This also is under the jurisdiction of the Waste Management Branch.

IX SOURCES OF WATER POLLUTION

(For sampling point locations refer to enclosed map)

Gull Lake Area (Tables I & II)

(a) Storm Sewer Discharges

During the inspection three storm sewers were found to be discharging to Gull Lake. These discharges are designated as GR-105W, GR-5AW and GR-4AW. Samples taken from GR-105W and GR-5AW revealed that most of the pollution in these sewer discharges is from natural sources and not domestic sewage. The effluent from the storm sewer outlet designated as GR-4AW was found to contan high faecal coliform counts. It was established that this contamination was originating from two septic drains designated as GR-51P and GR-49D on the Pinedale Lodge property. The problem was reported to the local health unit office and the faulty systems were corrected.

(b) Creek Discharges

The only creek discharge into Gull Lake is located along the southerly portion of Pinedale Road. The sampling point designated as GR-47C was established at the mouth of the creek. The creek drains the property behind some 10 or 12 cottages. Two sets of sample results indicated that the effluent was typical of natural runoff.

(c) Gull Lake Water Quality

For this pollution survey, ten sampling points were selected along the westerly shore of Gull Lake. These sampling points are designated as G-1 to G-10 and the results from two sets of samples taken indicate a general degradation of the water quality during the summer months. It is natural to have some degradation during the summer months especially in recreational areas, however, the water quality was satisfactory for all recreational uses.

Muskoka Bay Area

Most of the land around the survey area drains to Muskoka Bay. Also storm drainage, where feasible, is directed to the bay and away from Gull Lake.

(a) Musquash Road Area (Table III)

For the purposes of this survey, this area will include the developed sections of town encompassed by Bay Street West, North Street, McPherson Street, Private Street and Musquash Road.

The creek upstream from the developed area (GR-1C) was not polluted.

Samples collected near Private Street (GR-3C) contained high faecal streptococcus coliforms which would suggest that animal wastes are gaining access to the creek.

Results from sampling point opposite Charles Street (GR-7C) indicate that human wastes are entering the creek in the area of McPherson and Charles Street.

Results from samples taken at McPherson Street (GR-5D) indicate impairment mainly from animal wastes.

Samples taken from a ditch draining the property owned by Bay Ridges Cabins (GR-9A) indicate impairment from human wastes.

Samples taken on North Street (GR-11D and GR-13D) contained excess faecal coliform counts which would imply malfunctioning of private septic tanks and tile fields in this area during wet periods.

Samples taken from the ditch draining the south-easterly portion of Musquash Road (GR-15D) and creek samples (GR-17C) contained high faecal streptococcus bacteria which indicates animal waste contamination.

In conclusion, the pollution survey in this area indicates that water quality impairment in the most southerly portion is due to improper handling of animal wastes. However, towards the bay it becomes

apparent that inadequate sewage disposal systems are contributing to the pollution of the bay.

(b) <u>Southern Drainage Area</u> (Table IV)

This area, for the purposes of this survey, will include all sections of the survey south of Issac Street which have not previously been discussed.

The main drainage of this area is a creek flowing westerly along the Canadian National Railway tracks, past the sewage treatment plant, and into Muskoka Bay. A sampling point (GR-23C) just upstream of the sewage treatment plant discharge was established to serve as a monitoring point for the combined effect of discharges into the creek upstream of the sewage treatment plant.

In general, the water in this creek at the point designated as GR-23C appears to be of satisfactory quality. The exception to this was encountered during a rainy period on July 5th and 6th. At this time, samples taken at GR-23C contained extremely high concentrations of faecal coliforms which indicate the presence of human wastes. It appeared that the storm sewer discharge at David Street (GR-3AW) and the ditch discharge at the corner of First and Main Streets (GR-41D) were the main contributors to the high faecal count. The analysis results of the

discharge at David Street indicated contamination from human waste. The ditch discharge water appears to be contaminated by animal waste due to the high faecal streptococcus concentration in the sample.

Three sets of samples were taken of the creek at GR-23C, the sewage plant effluent (GR-25T) and the combined flow at Muskoka Bay (GR-27C). On all three occasions, the sample results indicated a satisfactory plant effluent. The results indicated partial disinfection of the creek water due to the chlorine in the sewage treatment plant effluent.

A sample taken from a culvert at Muskoka Road and Edward Street (GR-73D) on July 6th indicated a faecal coliform count in excess of 300 per 100 ml. The only apparent source of contamination would be from inadequate private septic tank systems. The adverse results occurred only during the wet period.

Creek flows to storm drains at Bay Street West (GR-83C) and Austin Street (GR-89C) both had faecal coliform counts in excess of 200 per 100 ml on July 6th. This would suggest infiltration from private sewage systems as no discharges were observed.

(c) <u>Northern Drainage Area</u> (Table V)

For purposes of this survey, this area will

include all the land north of Issac Street under investigation and not previously discussed.

In this area, eight sampling points were established. The results from two of the points indicated contamination from human wastes.

Results from a sample taken on July 6 from a creek at the end of Wagner Street (GR-99C) indicated faecal coliform in excess of 300 organisms per 100 ml. Results of a sample taken the same day from a creek crossing Lorne Street just west of Muskoka Road indicated faecal coliform in excess of 1,000 organisms per 100 ml. As no direct discharges were observed upstream from these sampling points the results appears to be caused from infiltration from faulty septic tank systems.

(d) Muskoka Bay Water Quality (Table VI)

For the purpose of obtaining a general idea of the water quality in Muskoka Bay six sampling points were established and samples were taken at various times during the summer season (see sampling points MU-1, 1A, 1B, 1C, 1D, 1E). The results obtained from samples taken indicate that from a bacteriological standpoint, the water is of a satisfactory quality for all recreational uses.

During the early part of September, 1971, a more detailed sampling of the water quality in Muskoka Bay was done by OWRC under its Recreational Lakes Programme. A preliminary review of the analysis results indicated similar low faecal and faecal streptococcus coliform concentrations; however, the total coliform concentrations were considerably higher than that obtained from the samples taken for this report. The Recreational Lakes Programme results will be published in a report early in 1972 after a detailed evaluation of the analysis results is made.

Aesthetically the water quality has been affected at various times during the past few years by algal "Blooms". The abundant growth of algae in the bay is a result of nutrient enrichment (nitrogen and phosphorus). The two main suppliers of nutrients to the bay are the sewage treatment plants serving the Town of Gravenhurst and the Ontario Hospital. Since the nutrients are mainly obtained from human activities the problem of faulty septic tank systems are also a factor in this enrichment and should not be overlooked.

In an effort to combat this enrichment problem, the Town of Gravenhurst and the Ontario Hospital authorities in conjunction with the Ontario Water Resources Commission are at present conducting tests

for phosphorus removal at the two sewage treatment plants. Although these experimental facilities have been recently installed, early reports indicate that phosphorus removal of greater than 80% are being obtained.

In early 1971, a phosphorus removal program was established whereby most sewage treatment plants in Ontario would have phosphorus removal equipment capable of 80% removal permanently installed by certain dates. Sewage plants in suspected problem areas such as Muskoka Bay, must have this phosphorus removal by 1973. However, in an attempt to correct the problem in the bay, the Town of Gravenhurst has pledged the installation of phosphorus removal facilities as soon as tests could be completed. Full plant scale phosphorus removal was started at the Gravenhurst sewage treatment plant during July, 1971. The Ontario Hospital plant started removal during September, 1971.

X PREVIOUS REPORT RECOMMENDATIONS

In a previous pollution survey report of 1964, the following recommendation was presented:

1. It is recommended that consideration be given to improving the treatment efficiency of the Gravenhurst sewage treatment plant.

This recommendation has been implemented with the converstion of the old high rate bio-filtration plant to a conventional activated sludge plant in 1967.

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APPENDIX I

TOWN OF GRAVENHURST

WATER PUMPAGE RECORDS - 1969

MONTH	GULL LAKE (GAL.)	NELSON STREET (GAL.)	TOTAL (GAL.)	AVERAGE DAY (GAL.)
January	5,520,000	-	5,520,000	178,000
February	6,810,000	-	6,810,000	243,000
March	7,770,000	-	7,770,000	251,000
April	6,780,000	410,000	7,190,000	240,000
May	660,000	7,036,000	7,696,000	248,000
June	3,450,000	7,938,000	11,388,000	380,000
July	5,760,000	10,606,000	16,366,000	528,000
August	1,110,000	11,968,000	13,078,000	422,000
September	1,110,000	8,693,000	9,803,000	327,000
October	-	9,248,000	9,248,000	298,000
November	30,000	7,785,000	7,815,000	261,000
December	7,110,000	-	7,110,000	230,000

SUMMARY

TOTAL FLOW	-	109,794,000 gallons
AVERAGE DAY FLOW (First Eight Montsh)	-	312,008 gallons
AVERAGE DAY FLOW	-	300,805 gallons
*MAXIMUM DAY FLOW	-	752,013 gallons
**PEAK HOUR FLOW	-	902,415 gallons
***PER CAPITA CONSUMPTION	-	92 gpd

* Based on a factor of 2.5 x average day flow

** Based on a factor of 3 x average day flow

*** Based on average day flow and a population of 3,283 persons

APPENDIX II

TOWN OF GRAVENHURST

WATER PUMPAGE RECORDS - 1970

MONTH	GULL LAKE (GAL.)	NELSON STREET (GAL.)	TOTAL (GAL.)	AVERAGE DAY (GAL.)
January	8,040,000	-	8,040,000	259,000
February	7,920,000	-	7,920,000	283,000
March	9,150,000	-	9,150,000	294,000
April	8,250,000	-	8,250,000	275,000
May	90,000	8,230,000	8,320,000	268,000
June	2,670,000	10,700,000	13,370,000	445,000
July	1,770,000	10,850,000	12,620,000	407,000
August	5,580,000	11,430,000	17,010,000	548,000
September	1,040,000	7,310,000	8,350,000	278,000
October	-	8,340,000	8,340,000	269,000
November	570,000	7,860,000	8,430,000	280,000
December	6,750,000	2,280,000	9,030,000	290,000

SUMMARY

TOTAL FLOW	-	117,870,000 gallons
AVERAGE DAY FLOW (first 8 months)	-	348,477 gallons
AVERAGE DAY	-	322,931 gallons
*MAXIMUM DAY	-	807,328 gallons
**PEAK HOUR	-	968,793 gallons
***PER CAPITA CONSUMPTION	-	97 gpd

* Based on a factor of 2.5 x average day flow

** Based on a factor of 3 x average day flow

*** Based on average day flow and a population of 3,322 persons

APPENDIX III

TOWN OF GRAVENHURST

WATER PUMPAGE RECORDS - 1971

MONTH	GULL LAKE (GAL.)	NELSON STREET (GAL.)	LORNE STREET (GAL.)	TOTAL (GAL.)	AVERAGE DAY (GAL.)
January	10,590,000	59,000	-	10,649,000	343,516
February	9,180,000	-	-	9,180,000	327,857
March	10,140,000	85,000	-	10,225,000	329,839
April	5,445,000	3,162,000	-	8,607,000	286,900
May	1,410,000	9,731,000	-	11,141,000	359,387
June	3,915,000	10,290,000	-	14,205,000	473,500
July	2,715,000	10,933,000	-	13,648,000	440,258
August	1,365,000	6,963,000	13,681,500	22,009,500	709,984

SUMMARY

TOTAL FLOW	-	99,664,500 gallons
AVERAGE DAY	-	410,142 gallons
*MAXIMUM DAY	-	1,025,355 gallons
**PEAK HOUR	-	1,230,426 gallons
***PER CAPITA CONSUMPTION	-	123 gal./day

* Based on a factor of 2.5 x average day flow
** Based on a factor of 3 x average day flow
*** Based on average day flow and a population of 3,322 persons

APPENDIX IV

TOWN OF GRAVENHURST

WATER POLLUTION CONTROL PLANT

1969 PLANT RECORDS

MONTH	TOTAL FLOW (GAL.)	AVERAGE DAY FLOW (GAL.)	MAXIMUM DAY FLOW (GAL.)	MINIMUM DAY FLOW (GAL.)
January	6,914,000	222,500	405,000	162,500
February	6,412,700	229,000	373,800	147,900
March	8,154,700	263,000	422,500	173,700
April	7,720,000	257,000	333,800	196,500
May	7,780,000	251,000	386,800	190,300
June	6,754,000	225,000	383,000	131,400
July	6,444,900	208,000	311,100	141,800
August	6,558,000	211,500	324,100	150,400
September	4,845,000	161,500	278,800	115,400
October	5,866,000	189,000	325,000	114,670
November	7,369,000	246,000	359,900	191,900
December	5,242,000	169,000	294,500	141,600

SUMMARY

TOTAL FLOW	-	80,060,300 gallons
AVERAGE DAY FLOW (First eight months)	-	233,491 gallons
AVERAGE DAILY FLOW	-	220,000 gallons
MAXIMUM DAY FLOW	-	422,500 gallons
MINIMUM DAY FLOW	-	114,670 gallons

APPENDIX V

TOWN OF GRAVENHURST

WATER POLLUTION CONTROL PLANT

1970 PLANT RECORDS

MONTH	TOTAL FLOW (GAL.)	AVERAGE DAY FLOW (GAL.)	MAXIMUM DAY FLOW (GAL.)	MINIMUM DAY FLOW (GAL.)
January	5,330,000	172,000	285,000	121,000
February	3,842,000	137,000	248,000	129,000
March	5,637,000	182,000	452,000	112,000
April	7,533,000	251,000	371,000	138,000
May	5,969,000	192,000	374,000	114,000
June	4,890,000	163,000	219,000	120,000
July	6,837,000	220,000	295,000	149,000
August	5,931,000	192,000	275,000	122,000
September	5,016,000	167,000	245,000	104,000
October	5,970,000	192,000	279,000	113,000
November	6,879,000	228,000	277,000	109,000
December	5,883,000	191,000	300,000	127,000

SUMMARY

TOTAL FLOW	-	69,712,000 gallons
AVERAGE DAY FLOW (first 8 months)	-	189,173 gallons
AVERAGE DAY FLOW	-	191,000 gallons
MAXIMUM DAY FLOW	-	452,000 gallons
MINIMUM DAY FLOW	-	109,000 gallons

APPENDIX VI

TOWN OF GRAVENHURST

WATER POLLUTION CONTROL PLANT

1971 PLANT RECORDS

MONTH	TOTAL FLOW (GAL.)	AVERAGE DAY FLOW (GAL.)	MAXIMUM DAY FLOW (GAL.)	MINIMUM DAY FLOW (GAL.)
January	6,554,700	211,442	362,700	105,900
February	6,073,000	216,893	288,200	180,100
March	6,973,700	224,958	354,100	144,500
April	12,067,200	402,240	629,000	224,200
May	10,267,700	331,216	479,700	208,600
June	8,963,900	298,797	559,600	189,500
July	10,665,100	344,035	528,900	230,900
August	9,536,500	307,629	362,800	220,000

SUMMARY

TOTAL FLOW	-	71,101,800 gallons
AVERAGE DAY FLOW	-	292,600 gallons
MAXIMUM DAY FLOW	-	629,000 gallons
MINIMUM DAY FLOW	-	105,900 gallons

APPENDIX VII

TOWN OF GRAVENHURST

WATER POLLUTION CONTROL PLANT

ANALYSIS RESULTS - 1969

DATE	RAW SEWAGE		FINAL EFFLUENT	
	BOD	SS	BOD	SS
January 14	220	220	20	20
February 25	100	200	11	20
March 24	85	100	16	20
May 1	85	155	9	15
June 18 *	42	79	6	6
July 18 *	-	-	6	6

* Averaged Values for composite samples. All figures in ppm

SUMMARY

Source	AVERAGE (ppm) BOD	SS
Raw Sewage	106	151
Final Effluent	11	15
Percent Reduction	89.5%	90%

APPENDIX VIII

TOWN OF GRAVENHURST

WATER POLLUTION CONTROL PLANT

ANALYSIS RESULTS - 1970

DATE	RAW SEWAGE		FINAL EFFLUENT	
	BOD	SS	BOD	SS
January 21	150	100	13	15
February 24	170	170	16	15
March 11	95	130	7	10
March 24	170	125	3	5
April 20*	57	61	13	13
April 30	85	70	13	5
May 25	100	115	7	5
June 3*	57	68	21	8
June 30	240	200	11	10
August 10*	129	75	76	53
August 11	170	80	40	50
October 19	190	220	14	15
October 28	130	240	14	25

* Averaged values from composite samples. All figures in ppm

SUMMARY

SOURCE	AVERAGE (ppm)	
	BOD	SS
Raw Sewage	134	127
Final Effluent	19	18
Percent Reduction	86%	86%

APPENDIX IX

TOWN OF GRAVENHURST

WATER POLLUTION CONTROL PLANT

ANALYSIS RESULTS - 1971 up to September 1

DATE	RAW SEWAGE		FINAL EFFLUENT	
	BOD	SS	BOD	SS
January 25*	130	100	12	5
January 26*	73	60	21	8
February 2	120	100	11	20
February 15	140	110	12	20
March 1	140	150	42	20
March 22	80	110	12	10
April 20	34	25	11	10
May 3	-	-	6.5	10
May 10*	135	165	30	30
May 20*	85	90	7.5	10
May 27*	340	880	10	20
May 28*	180	380	7	7
May 29*	180	275	7	5
May 30*	54	150	7	5
June 16*	110	100	10	20
July 3	-	-	14	10
August 16	-	-	5.5	5

SUMMARY SOURCE	AVERAGE (ppm)	
	BOD	SS
Raw Sewage	129	193
Final Effluent	13.3	13.0
Percent Reduction	89.5%	93%

TABLE I

GULL LAKE - STORM SEWER AND CREEK DISCHARGE SAMPLING POINT RESULTS

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	PHENOLS IN PPB	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITRITE	NITRATE	FREE AMMONIA	PHOSPHORUS AS P (PPM) TOTAL	SOLUBLE	ABS (PPM)	M.F. COLIFORM PER 100 ML	FAECAL COLIFORMS PER 100 ML	FAECAL STREPTOCOCCUS PER 100 ML	ETHER SOLUBLES (PPM)
GR-105W	Storm Sewer Discharge	7/5/71	0.4	160	5	4							0.1	10	<10	<10	0
	West of Hwy. 11	6/7/71	1.2	290	5	2	.88	.014	.21	.01	.064	.016	0.1	1,000	10	150	<2
		17/8/71	NO	FLOW													
GR-5AW	Storm sewer Outlet	5/5/71	1.6	600	5	3	0.22	0.004	2.6	0.02	.016	.004	0.1	-	-	-	2
	East of Hwy. #11	6/7/71	0.8	530	5	15	.66	.015	1.3	.01	.068	<.001	0.0	4,500	180	30	2
		17/8/71	2.0	285	5	10	.61	.023	.48	.05	.044	.019	0.3	336	28	1	0
GR-4AW	Creek as it enters	5/5/71	0.8	20	5	2	1.5	.028	0.09	1.1	.086	.047	0.1	18,000	670	330	2
	Gull Lake	6/7/71	NO	FLOW													
		17/8/71	NO	FLOW													
GR-47C	Creek Behind Cottages	4/5/71	0.4	20	5	4	.64	.002	<.01	.17	.033	.012	0.0	20	<10	10	TRACE
	on Fairview Drive at	6/7/71	0.4	70	5	2	.34	.003	.03	.01	.014	<.001	0.0	1,200	<10	90	<2
	Gull Lake	16/8/71	NO	FLOW													
GR-49D	Drain From Pinedale	5/5/71	5.5	100	25	4	7.3	.009	.02	4.6	.28	.052	0.2	510	70	10	0
	Lodge Septic Bed	6/7/71	NO	FLOW													
		17/8/71	NO	FLOW													
GR-51P	Private Drain From	5/5/71	700	1,180	990	100	79.0	.017	<.01	31.0	10.0	.34	1.7	15,500,00	300,000	59,000	121
	Septic Bed Opposite	6/7/71	NO	FLOW													
	Pinedale Lodge	17/8/71	NO	FLOW													

TABLE II

GULL LAKE - SAMPLING POINT RESULTS

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM)		PHENOLS IN PPB	NITROGEN AS N (PPM)				PHOSPHORUS AS P (PPM)		ABS (PPM)	M.F. COLIFORM PER 100 ML	FAECAL COLIFORMS PER 100 ML	FAECAL STREPTOCOCCUS PER 100 ML	ETHER SOLUBLES (PPM)
				TOTAL	SUSP.		TOTAL KJELDAHL	NITRITE	NITRATE	FREE AMMONIA	TOTAL	SOLUBLE					
G-1	GULL LAKE	7/5/71	1.4	20	5	2							0.0	<10	<10	<10	0
		7/7/71	0.4	60	5	2	.32	.002	<.01	.03	.016	.014	0.1				0
		18/8/71	0.8	160	5	2	.25	.004	<.01	<.01	.010	<.001	0.0	360	124	1	0
G-2	GULL LAKE	7/5/71	0.8	30	5	2							0.1	10	<10	<10	0
		7/7/71	0.2	60	5	2	.32	.002	<.01	.09	.012	<.001	0.0				4
		18/8/71	1.0	140	5	4	.29	.005	<.01	.01	.010	.001	0.0	260	4	4	<1
G-3	GULL LAKE	7/5/71	2.5	30	5	4							0.1	<10	<10	<10	TRACE
		7/8/71	.6	50	5	10	.28	.004	.04	.01	.016	.002	0.0				<1
		18/8/71	.6	150	5	2	.25	.004	<.01	.01	.014	.001	0.0	1	1	1	<1
G-4	GULL LAKE	7/5/71	1.2	30	5	4							0.0	10	<10	<10	TRACE
		7/7/71	.8	50	5	2	.27	.003	.01	.01	.014	.002	0.0				<1
		18/8/71	.6	150	5	2	.25	.004	<.01	.01	.014	.001	0.0	36	4	1	<1
G-5	GULL LAKE	7/5/71	1.4	30	5	2							0.1	<10	<10	<10	0
		7/7/71	1.0	50	5	2	.24	.004	.01	.01	.012	.002	0.0				2
		18/8/71	.6	150	5	2	.26	.004	.01	<.01	.013	.006	0.0	32	1	1	<1
G-6	GULL LAKE	7/5/71	1.6	20	5	4							0.0	<10	<10	<10	TRACE
		7/7/71	1.0	25	5	30	.27	.004	≤.01	.02	.012	.002	0.0				<2
		18/8/71	1.0	170	5	2	.18	.005	<.01	<.01	.014	.002	0.0	44	1	1	<2

TABLE II - (CONT'D)

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	PHENOLS IN PPB	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITRITE	NITRATE	FREE AMMONIA	PHOSPHORUS AS P (PPM) TOTAL	SOLUBLE	ABS (PPM)	M.F. COLIFORM PER 100 ML	FAECAL COLIFORMS PER 100 ML	FAECAL STREPTOCOCCUS PER 100 ML	ETHER SOLUBLES (PPM)
G-7	GULL LAKE	7/5/71	1.8	30	5	2							0.0	<10	<10	<10	TRACE
		7/7/71	1.2	60	10	2	.72	.004	<.01	.03	.054	<.001	0.0				<1
		18/8/71	1.0	160	5	2	.31	.004	<.01	.03	.034	.007	0.0	48	1	1	<1
G-8	GULL LAKE	7/5/71	1.8	40	5	4							0.0	<10	<10	<10	0
		7/7/71	1.0	45	10	2	.20	.004	<.01	.01	.012	<.001	0.0				2
		18/8/71	.8	160	5	2	.24	.005	<.01	<.01	.011	<.001	0.0	76	12	1	0
G-9	GULL LAKE	7/5/71	1.6	20	5	2							0.0	<10	<10	<10	TRACE
		7/7/71	1.0	50	5	2	.25	.004	<.01	.02	.012	<.001	0.0				<1
		18/8/71	1.0	150	5	2	.42	.004	<.01	.01	.018	.001	0.0	532	20	20	<2
G-10	GULL LAKE	7/5/71	1.4	30	5	2							0.1	<10	<10	<10	TRACE
		7/7/71	1.0	50	5	8	.22	.004	<.01	.02	.012	<.001	0.0				<1
		18/8/71	1.2	160	5	2	.17	.004	<.01	<.01	.009	<.001	0.0	440	1	1	0

TABLE III

MUSQUASH ROAD AREA - SAMPLING POINT RESULTS

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	PHENOLS IN PPB	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITRITE	NITRATE	FREE AMMONIA	PHOSPHORUS AS P (PPM) TOTAL	SOLUBLE	ABS (PPM)	M.F. COLIFORM PER 100 ML	FAECAL COLIFORMS PER 100 ML	FAECAL STREPTOCOCCUS PER 100 ML	ETHER SOLUBLES (PPM)
GR-1C	CREEK AT NORTH END OF	3/5/71	1.0	25	5		.41				.020		0.0	10	<10	<10	0
	MUSQUASH ROAD - NORTH	5/7/71	NO	FLOW													
	SIDE OF ROAD	16/8/71	NO	FLOW													
GR-3C	CREEK ON WEST SIDE	3/5/71	0.8	50	5		.41				.020		0.0	13,900	20	20	0
	OF PRIVATE STREET	5/7/71	16	260	65	6	5.0	.018	1.2	.29	.87	.24	.2	630,000	2,100	10,600	3
		16/8/71	NO	FLOW													
GR-5D	DITCH EAST OF	3/5/71	1.0	320	5		.37				.014		0.0	70	<10	<10	0
	MCPHERSON STREET AT	5/7/71	5.0	710	55	10	1.5	.012	2.6	.92	.12	<.001	0.1	4,000	100	900	2
	HIGHWAY 69	16/8/71	NO	FLOW													
GR-7C	CREEK ON NORTH SIDE	3/5/71	1.2	140	5		.44				.034		0.0	1,370	20	140	0
	OF HIGHWAY 69 JUST	5/7/71	22	370	40	6	1.5	.066	.87	.41	.19	.028	0.1	56,000	1,900	1,100	4
	BEFORE CHARLES STREET	16/8/71	1.0	460	5	2	1.5	.033	.59	.73	.046	.002	0.1	24	24	12	0
GR-9D	DITCH UNDER HIGHWAY	3/5/71	1.2	210	5		.54				.016		0.0	145	430	20	0
	69 AT BAY RIDGES CABINS	5/7/71	5.0	210	25	4	.95	.036	.84	.09	.11	.008	0.1	168,000	6,200	3,300	5
		16/8/71	NO	FLOW													
GR-11D	DITCH ON WEST SIDE OF	3/5/71	4.5	560	10		1.2				.16		0.1	36,500	800	80	0
	NORTH STREET AT	5/7/71	NO	FLOW													
	HIGHWAY 69	16/8/71	NO	FLOW													

TABLE III - (CONT'D)

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	PHENOLS IN PPB	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	NITROGEN AS N (PPM) FREE AMMONIA	PHOSPHORUS AS P (PPM) TOTAL	PHOSPHORUS AS P (PPM) SOLUBLE	ABS (PPM)	M.F. COLIFORM PER 100 ML	FAECAL COLIFORMS PER 100 ML	FAECAL STREPTOCOCCUS PER 100 ML	ETHER SOLUBLES (PPM)
GR-13D	DITCH AT NORTH SIDE OF	3/5/71	0.8	270	15		1.1				.31		0.1	4,700	100	10	0
	NORTH STREET BY LUMBER	5/7/71	NO	FLOW													
	YARD	16/8/71	NO	FLOW													
GR-15D	DITCH AT MUSQUASH ROAD	3/5/71	1.0	120	5		.34				.014		0.0	30	20	40	0
	AND HIGHWAY 69	5/7/71	3.0	170	10	2	.62	.020	.20	<.01	.084	.010	0.1	14,000	420	620	4
		16/8/71	NO	FLOW													
GR-17C	CREEK CROSSING	3/5/71	0.8	60	5		.55				.020		0.0	20	<10	<10	0
	MUSQUASH ROAD JUST	5/7/71	2.0	250	15	4	.75	.014	.06	.06	.11	.008	0.1	28,000	150	830	6
	WEST OF BAY RIDGES	16/8/71	1.4	140	15	30	1.6	.034	<.01	.17	.13	.052	0.0	224	36	36	<1
	CABINS																

TABLE IV

MUSKOKA BAY SOUTHERN DRAINAGE AREA - SAMPLING POINT RESULTS

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	PHENOLS IN PPB	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	NITROGEN AS N (PPM) FREE AMMONIA	PHOSPHORUS AS P (PPM) TOTAL	PHOSPHORUS AS P (PPM) SOLUBLE	ABS (PPM)	M.F. COLIFORM PER 100 ML	FAECAL COLIFORMS PER 100 ML	FAECAL STREPTOCOCCUS PER 100 ML	ETHER SOLUBLES (PPM)
GR-19D	DITCH ON WEST SIDE OF	3/5/71	1.2	45	5		.29				.036		0.0	1,240	<10	10	0
	DUMP ROAD	5/7/71	4.0	90	15	2	.60	.010	.21	.05	.044	.002	.1	15,000	260	10	8
		16/8/71	NO	FLOW													
GR-21C	CREEK CROSSING	3/5/71	0.8	25	5		.27				.022		0.0	10	<10	<10	0
	MULDREW LAKE ROAD	5/7/71	1.6	80	15	4	1.3	.011	.03	.66	.080	<.001	0.1	49,000	180	1,700	6
	JUST BEFORE DUMP ROAD	16/8/71	1.4	90	15	2	1.1	.007	.01	.63	.040	.005	0.0	60	60	20	0
GR-23C	CREEK JUST BEFORE	3/5/71	1.2	100	5		.48				.032		0.0	60	<10	<10	0
	GRAVENHURST SEWAGE	5/7/71	4.0	180	50	4	.85	.026	.80	.06	.19	.002	0.1	510,000	12,000	1,700	4
	TREATMENT PLANT	16/8/71	0.4	190	5	2	.34	.015	1.2	.02	.032	.006	0.0	760	30	70	0
	DISCHARGE																
GR-25T	GRAVENHURST SEWAGE	3/5/71	6.5	240	10		16.0				4.0		0.4	<10	<10	<10	0
	TREATMENT PLANT	5/7/71	14	280	10	6	19	.039	.05	12	4.5	2.5	0.5	550,000	<10	<10	3
	FINAL EFFLUENT	16/8/71	5.5	430	5	15	22	.021	.06	20	.55	.081	1.3	72	1	1	<1
GR-27C	CREEK FLOWING PAST	3/5/71	2.0	130	10		3.8				.82		0.1	<10	<10	<10	0
	GRAVENHURST SEWAGE	5/7/71	13	310	160	6	7.0	.13	.43	2.9	2.5	.66	0.2	290,000	3,000	500	5
	TREATMENT PLANT AS IT	16/8/71	13	400	45	8	11.0	.97	.60	9.4	.75	.084	0.4	420	4	<10	0
	ENTERS LAKE MUSKOKA																

TABLE IV - (CONT'D)

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	PHENOLS IN PPB	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	NITROGEN AS N (PPM) FREE AMMONIA	PHOSPHORUS AS P (PPM) TOTAL	PHOSPHORUS AS P (PPM) SOLUBLE	ABS (PPM)	M.F. COLIFORM PER 100 ML	FAECAL COLIFORMS PER 100 ML	FAECAL STREPTOCOCCUS PER 100 ML	ETHER SOLUBLES (PPM)
GR-29D	DITCH AT NORTH-EAST	3/5/71	0.4	20	5		.22				.020		0.0	<10	<10	<10	0
	CORNER OF MULDREW	5/7/71	0.4	70	5	4	.60	.006	.03	.20	.064	.027	0.1	226,000	300	310	4
	LAKE ROAD &	16/8/71	N O	F L O W													
	MUSQUASH ROAD																
GR-31D	DITCH ON SOUTH SIDE	3/5/71	1.4	140	5		.34				.020		0.0	<10	<10	<10	0
	OF MUSQUASH ROAD	5/7/71	N O	F L O W													
		16/8/71	N O	F L O W													
GR-33D	CULVERT DISCHARGE	4/5/71	1.4	180	5	2	.80	.015	2.6	.14	.050	.007	0.0	<10	<10	20	0
	SOUTH OF JAMES STREET	5/7/71	0.4	270	5	10	.34	.003	2.2	<.01	.026	.002	0.1	3,800	130	140	4
		16/8/71	N O	F L O W													
GR-35C	CREEK SOUTH OF JAMES	4/5/71	1.8	80	5	2	.78	.008	.84	.060	.052	.010	0.0	150	60	240	TRACE
	STREET BEFORE CULVERT	5/7/71	1.8	170	5	2	.94	.049	2.8	.46	.14	.065	0.1	4,700	190	390	8
		17/8/71	.2	280	5	2	.33	.011	4.3	.02	.016	.009	0.0				0
GR-37C	CREEK ON WEST SIDE OF	4/5/71	2.5	80	5	8	.70	.010	.07	.04	.060	.008	0.1	60	<10	10	0
	JOHN STREET	5/7/71	1.2	160	5	6	.60	.021	.31	.10	.080	.012	0.1	26,000	110	240	4
		16/8/71												348	12	232	
GR-41D	DITCH AT SOUTH-EAST	4/5/71	3.0	40	5	4	.74	.012	.02	.05	.040	.009	0.1	10	10	60	0
	CORNER OF FIRST STREET	5/7/71	2.0	190	15	4	.75	.023	.70	.13	.070	<.001	0.1	7,600	230	530	3
	& MAIN STREET	16/8/71	N O	F L O W													

TABLE IV - (CONT'D)

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	PHENOLS IN PPB	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITRITE	NITRATE	FREE AMMONIA	PHOSPHORUS AS P (PPM) TOTAL	SOLUBLE	ABS (PPM)	M.F. COLIFORM PER 100 ML	FAECAL COLIFORMS PER 100 ML	FAECAL STREPTOCOCCUS PER 100 ML	ETHER SOLUBLE (PPM)
GR-43W	Ditch at Tourist	4/5/71	7.0	60	5	6	1.1	.012	.03	.05	.02	.009	0.0	30	<10	30	TRACE
	Information Road	5/7/71	2.0	220	15	8	.35	.021	.60	.24	.040	<.001	0.1	5,100	370	530	2
		16/8/71	NO	FLOW													
GR-45W	Ditch on Fairview	4/5/71	2.0	40	5	8	1.2	.018	<.01	.04	.024	.012	0.0	30	<10	10	TRACE
	Drive	5/7/71	5.0	320	15	6	.95	.016	<.01	.03	.095	.003	0.1	310	40	30	4
		16/8/71	NO	FLOW													
GR-57D	Ditch Draining to	5/5/71	1.8	100	5	3	.60	.005	.002	.03	.032	.014	0.1	120	<10	<10	TRACE
	Gull Lake from	6/7/71	0.8	70	5	2	.54	.004	.006	.05	.036	<.001	0.0	2,600	40	20	<2
	Storm Sewer	17/8/71	1.0	170	5	2	.31	.006	<.01	.02	.015	.003	0.0	84	16	1	0
GR-69P	1½" Ø Private drain	6/5/71	0.6	280	5	2							0.1	<10	<10	<10	0
	opposite 250 Caroline	6/7/71	NO	FLOW													
	Street	17/8/71	NO	FLOW													
GR-71D	Ditch 200 feet South	6/5/71	2.5	140	10	4							0.1	20	<10	<10	2
	of Edward Street where	6/7/71	4.5	230	15	2	1.4	.007	.003	.02	.13	.008	0.1	7,000	10	60	2
	It Crosses Muskoka Road	17/8/71	4.0	350	15	4	.32	.007	<.01	.06	.026	.008	0.1	100	70	70	<1
GR-73D	Culvert at Muskoka Road	6/5/71	1.2	480	10	2							0.1	<10	<10	<10	0
	& Edward Street	6/7/71	3.0	900	5	4	1.7	.003	.01	.07	.084	<.001	0.1	13,000	320	340	6
		17/8/71	NO	FLOW													

TABLE IV - (CONT'D)

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	PHENOLS IN PPB	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	NITROGEN AS N (PPM) FREE AMMONIA	PHOSPHORUS AS P (PPM) TOTAL	PHOSPHORUS AS P (PPM) SOLUBLE	ABS (PPM)	M.F. COLIFORM PER 100 ML	FAECAL COLIFORMS PER 100 ML	FAECAL STREPTOCOCCUS PER 100 ML	ETHER SOLUBLE (PPM)
GR-75D	DITCH ALONG CLOVERLEAF	6/5/71	1.4	1280	15	2							0.1	<10	<10	<10	TRACE
	OPPOSITE EDWARD STREET	6/7/71	4.0	320	10	2	1.2	.014	.06	.08	.10	.004	0.1	24,000	60	120	2
		17/8/71	1.8	460	5	4	.38	.006	<.01	.10	.032	.017	0.1	28	1	1	0
GR-77C	CREEK RUNNING UNDER C.N.R.	6/5/71	0.2	100	5								0.0	60	<10	20	0
	RAILWAY TRACKS BY	6/7/71	NO	FLOW													
	MARGARET STREET	17/8/71	NO	FLOW													
GR-79C	CREEK AS IT CROSSES	6/5/71	0.2	100	5	10							0.0	50	<10	20	0
	FARM ROAD	6/7/71	NOT	SAMPLED													
		17/8/71	NOT	SAMPLED													
GR-81C	CREEK 100 FEET PAST	6/5/71	0.4	120	5	8							0.1	10	<10	<10	0
	THE END OF HUGHSTON STREET	6/7/71	NO	FLOW													
		17/8/71	NO	FLOW													
GR-83C	CREEK AS IT ENTERS	6/5/71	0.8	80	15								0.1	<10	<10	<10	0
	DITCH ON HIGHWAY 69	6/7/71	5.0	190	35	2	1.0	.009	.001	.02	.20	.025	0.1	4,000	230	<10	2
		17/8/71	NO	FLOW													
GR-85W	STORM SEWER DISCHARGE	6/5/71	0.2	340	5	0							0.0	10	<10	<10	0
		6/7/71	4.5	620	90	2	1.0	.040	.22	.25	.28	.004	0.1	12,000	10	320	2
		17/8/71	NO	FLOW													

TABLE IV - (CONT'D)

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	PHENOLS IN PPB	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	NITROGEN AS N (PPM) FREE AMMONIA	PHOSPHORUS AS P (PPM) TOTAL	PHOSPHORUS AS P (PPM) SOLUBLE	ABS (PPM)	M.F. COLIFORM PER 100 ML	FAECAL COLIFORMS PER 100 ML	FAECAL STREPTOCOCCUS PER 100 ML	ETHER SOLUBLE (PPM)
GR-87W	STORM SEWER DISCHARGE	6/5/71	0.2	130	5	4							0.1	10	<10	<10	0
	ON AUSTIN STREET	6/7/71	0.4	260	5	4	.42	.014	3.0	.03	.036	.002	0.1	3,900	100	20	<1
		17/8/71	0.4	310	5	0	.34	.012	3.0	.02	.020	.003	0.0	7,100	16	84	<1
GR-89C	CREEK ON AUSTIN	6/5/71	0.6	140	5	4							0.1	20	<10	<10	0
	STREET	6/7/71	0.2	150	5	15	.33	.002	3.3	.01	.016	<.001	0.0	1,400	210	270	3
		17/8/71	0.6	280	15	4	.31	.006	3.4	<.01	.015	<.001	0.0	436	28	96	<1
GR-3AW	STORM SEWER DISCHARGE	4/5/71	1.8	80	5	4	.78	.012	.03	.02	.040	.007	0.1	20	10	30	0
	AT DAVID STREET	5/7/71	2.0	170	10	2	1.0	.031	.81	.21	.064	<.001	0.1	19,000	1,000	700	3
		15/8/71	NO	FLOW													
GR-6AW	STORM SEWER DISCHARGE	7/5/71	NO	FLOW													
		6/7/71	NO	FLOW													
		18/8/71	NO	FLOW													
GR-7AW	STORM SEWER DISCHARGE	7/5/71	NO	FLOW													
		6/7/71	NO	FLOW													
		18/8/71	NO	FLOW													

TABLE V

MUSKOKA BAY NORTHERN DRAINAGE AREA - SAMPLING POINT RESULTS

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (F-M) TOTAL	SOLIDS (F-M) SUSP.	PHENOLS IN PPB	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITRITE	NITRATE	FREE AMMONIA	PHOSPHORUS AS P (PPM) TOTAL	SOLUBLE	ABS (PPM)	M.F. COLIFORM PER 100 ML	FAECAL COLIFORMS PER 100 ML	FAECAL STREPTOCOCCUS PER 100 ML	ETHER SOLUBLE (PPM)
GR-91D	DITCH ON SOUTH SIDE	6/5/71	4.5	200	90	6							0.3	20	<10	<10	0
	OF GEORGE STREET	6/7/71	NO	FLOW													
		17/8/71	NO	FLOW													
GR-93C	CREEK AT END OF	7/5/71	0.6	100	5	40							0.1	50	<10	10	0
	WINEWOOD AVENUE	6/7/71	NO	FLOW													
		17/8/71	NO	FLOW													
GR-95D	DRAIN AT END OF	7/5/71	0.8	140	5	0							0.1	120	<10	<10	0
	FARQUAT STREET	6/7/71	NO	FLOW													
		17/8/71	NO	FLOW													
GR-97W	CULVERT OUTLET	7/5/71	0.2	120	5	8							0.1	<10	<10	<10	0
	WEST OF ADAMSON	6/7/71	0.4	210	5	2	.29	.024	3.4	.01	.032	.017	0.0	2,200	20	30	<1
	STREET	17/8/71	0.6	230	5	2	.18	.025	2.5	.05	.010	<.001	0.0	468	1	48	0
GR-99C	CREEK AT END OF	7/5/71	0.8	150	10	2							0.1	180	100	20	0
	WAGNER STREET	6/7/71	0.5	330	140	0	1.1	.004	3.7	<.01	.17	<.001	0.2	9,000	330	30	0
		17/8/71	NO	FLOW													

TABLE V

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	PHENOLS IN PPB	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITRITE	NITRATE	FREE AMMONIA	PHOSPHORUS AS P (PPM) TOTAL	SOLUBLE	ABS (PPM)	M.F. COLIFORM PER 100 ML	FAECAL COLIFORMS PER 100 ML	FAECAL STREPTOCOCCUS PER 100 ML	ETHER SOLUBLE (PPM)
GR-101D	DITCH ON NORTH SIDE	7/5/71	0.6	180	35	4							0.1	80	<10	80	0
	OF LORNE STREET	6/7/71	1.6	320	200	2	1.3	.009	.17	.01	.22	<.001	0.0	3,900	140	130	0
		17/8/71	NO	FLOW													
GR-103C	CREEK ON NORTH	7/5/71	1.0	160	5	10							0.1	20	<10	<10	0
	SIDE OF LORNE	6/7/71	1.6	180	10	2	.37	.060	1.1	.15	.018	<.001	0.0	1,000	10	<10	<2
	STREET	17/8/71	1.6	370	5	15	.42	.032	.11	.02	.030	.003	0.0	13,700	1,200	88	0

TABLE VI

MUSKOKA BAY - SAMPLING POINT RESULTS

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SOLIDS (PPM) SUSP.	PHENOLS IN PPB	NITROGEN AS N (PPM) TOTAL KJELDAHL	NITROGEN AS N (PPM) NITRITE	NITROGEN AS N (PPM) NITRATE	NITROGEN AS N (PPM) FREE AMMONIA	PHOSPHORUS AS P (PPM) TOTAL	PHOSPHORUS AS P (PPM) SOLUBLE	ABS (PPM)	M.F. COLIFORM PER 100 ML	FAECAL COLIFORMS PER 100 ML	FAECAL STREPTOCOCCUS PER 100 ML	ETHER SOLUBLE (PPM)
MU-1A	LAKE MUSKOKA	5/5/71	1.4	60	5	2							0.1	20	<10	<10	0
		28/5/71	1.2	80	5				.05		.050						
		7/7/71	1.2	25	5	30	.60	.005	.01	.19	.068	.025	0.0				4
		18/8/71	1.6	160	5	2	.47	.007	.02	.03	.028	.002	0.0	608	1	1	0
MU-1	LAKE MUSKOKA	5/5/71	0.8	30	5	2							0.1	<10	<10	<10	0
		28/5/71	1.2	80	5				.04		.052						
		7/7/71	1.0	50	5	2	.46	.004	<.0	.16	.040	.008	0.0				<1
		18/8/71	1.6	150	5	2	.39	.006	.01	.01	.020	<.001	0.0	432	1	1	0
MU-1B	LAKE MUSKOKA	7/7/71	1.2	50	5	2	.47	.004	<.01	.14	.034	.008	0.0				<2
		18/8/71	1.0	180	5	2	.44	.005	<.01	<.01	.022	<.001	0.0	32	4	1	<2
MU-1C	LAKE MUSKOKA	7/7/71	0.2	100	5	2	.55	.004	<.01	.28	.055	.030	0.0				0
		18/8/71	1.2	150	5	2	.42	.005	.01	<.01	.019	.001	0.0	20	1	1	<2
MU-1D	LAKE MUSKOKA	5/5/71	0.6	30	5	0							0.1	<10	<10	<10	0
		28/5/71	1.2	80	5				.03		.030						
		18/8/71	1.6	140	5	10	.43	.004	<.01	<.01	.021	<.001	0.0	60	1	1	0
NU-1E	LAKE MUSKOKA	5/5/71	0.4	30	5	4							0.1	<10	<10	<10	0
		28/5/71	1.2	80	5				.03		.030						
		7/7/71	0.2	90	5	2	.49	.003	<.01	.10	.026	.005	0.1				3
		18/8/71	1.6	160	5	2	.42	.004	<.01	.01	.018	.001	0.0	124	1	1	<2

APPENDIX X

WATER QUALITY AND EFFLUENT OBJECTIVES

The OWRC objectives for surface waters is described in a booklet entitled "Guidelines and Criteria for Water Quality Management in Ontario". A copy of the booklet is enclosed in the pocket on the back cover of this report This publication contains the guidelines and introduces water quality criteria for various uses including public, agricultural and industrial water supply, recreation, aesthetic enjoyment and the propagation of fish and wildlife. The guidelines should be followed to determine the acceptability of a watercourse for various uses.

A few pertinent maximum limits of contaminants in sewage treatment plant and industrial effluents are listed below. Adequate protection for surface waters except in certain specific instances influenced by local conditions, should be provided if the following concentrations and pH range are not exceeded.

5-Day BOD - not greater than 15 ppm

Suspended Solids - not greater than 15 ppm

Phenols - not greater than 20 ppb

pH - 5.5 to 10.6

Iron - not greater than 17 ppm

Ether Solubles (Oil) - not greater than 15 ppm

BACTERIOLOGICAL INDICATOR ORGANISMS

TOTAL COLIFORM organisms include a wide variety of bacteria ranging from the genus (group) Escherischia Coli (E. coli), which originate mainly in the intestines of man and other warm blooded animals, to the genera Citrobacter and Enterobacter aerogenes. The latter genera are basically found in soil but are also present in feces in small numbers. The presence of total coliforms in water may indicate soil run-off or, more important, less recent fecal pollution since organisms of the Enterobacter - Citrobacter groups tend to survive longer in water than do members of the Escherischia Coli group, and even to multiply when suitable environmental conditions exist.

The FECAL COLIFORM organisms are those coliform bacteria which are of intestinal origin and, therefore, are an indicator of recent fecal pollution. Most of the coliform bacteria found by the fecal coliform test are of the genus Escherichia Coli.

FECAL STREPTOCOCCI organisms are normal inhabitants of the large intestine of man and animals and generally do not multiply outside the human body. In waters polluted with fecal material, fecal streptococci are usually found along with fecal coliform bacteria but in smaller numbers. When the number of fecal streptococci bacteria approximates or is greater than the number of fecal coliform organisms, animals are the probable source.

The OWRC Guidelines and Criteria for Water Quality Management in Ontario (1970) indicate that water used for total body contact recreation can be considered impaired when the total coliform, fecal coliform, and/or fecal streptococcus geometric mean density exceeds 1000,100, and/or 20 per 100 ml, respectively.

NOTE: The term "geometric mean" refers to a type of average. Mathematically speaking, the geometric mean of a set of N numbers is the Nth root of the product of the numbers; in practice, it is computed by the use of logarithms.

GLOSSARY OF TERMS

Bacteriological Examinations - The Membrane Filter Technique is used to obtain a direct count of coliform organisms. These organisms are the normal inhabitants of the intestines of man and other warm-blooded animals. They are always present in large numbers in untreated sewage and are, in general, relatively few in number in other stream pollutants.

Biochemical Oxygen Demand (BOD) - The biochemical oxygen demand test indicates the amount of oxygen required for stabilization of the decomposable organic matter found in sewage, sewage effluent, polluted waters, or industrial wastes, by aerobic biochemical action.

Solids - The analyses for solids include tests for total, suspended and dissolved solids. The total solids is a measure of the solids in solution and in suspension. Suspended solids indicate the measure of undissolved solids of organic or inorganic nature whereas the dissolved solids are a measure of those solids in solution.

Oils and Ether Soluble Materials - These include oils and all other soluble materials such as tarry substances and greases. The presence of these pollutants renders water difficult and sometimes impractical to treat either for industrial or domestic use. Oils make streams unsightly and water unfit for bathing.

Phenolic Compounds - The presence of phenol or phenolic equivalents is generally associated with discharges containing petroleum products, or with wastes from some industries. It is generally conceded that adequate protection of surface waters will be provided if the concentration of phenols in waste discharges does not exceed 20 parts per billion (ppb). Phenolic type waste can cause objectionable conditions in water supplies and might taint the flesh of fish.

Alkyl Benzene Sulfonate (ABS) - The alkyl benzene sulfonate portion of the anionic detergents is reported in ppm. The test is generally employed to indicate the presence of domestic wastewater. The popular use of synthetic detergent for general cleaning purposes have resulted in the incidence of residual ABS in streams. As an objective, the ABS concentration should not exceed 0.5 ppm in water used for domestic purposes.

Iron - Water for domestic use should contain less than 0.3 parts per million of iron in order to avoid objectionable tastes, staining and sediment formation. Iron concentrations of not greater than 17 parts per million in waste discharges should permit adequate protection of surface waters.

Nitrogen

Ammonia Nitrogen or sometimes called free ammonia is the soluble product in the decomposition of nitrogenous

organic matter. It is also formed when nitrates and nitrites are reduced to ammonia either biologically or chemically. Some small amounts of ammonia, too, may be swept out of the atmosphere by rain water.

The following values may be of general significance in appraising free ammonia content: low 0.015 to 0.03 ppm; moderate 0.03 to 0.10 ppm; high 0.10 or greater.

Total Kjeldahl is a measure of the total nitrogenous matter present except that measured as nitrite and nitrate nitrogens. The Total Kjeldahl less the Ammonia Nitrogen measures the organic nitrogen present. Ammonia and organic nitrogen determinations are important in determining the availability of nitrogen for biological utilization. The normal range for Total Kjeldahl would be 0.1 to 0.5 ppm.

Nitrite Nitrogen

Nitrite is usually an intermediate oxidation of ammonia. The significance of nitrites, therefore, varies with their amount, sources, and relation to other constituents of the sample, notably the relative magnitude of ammonia and nitrite present. Since nitrite is rapidly and easily converted to nitrate, its presence in concentrations greater than a few thousandths of a part per million is

generally indicative of active biological processes in the water.

Nitrate Nitrogen

Nitrate is the end product of aerobic decomposition of nitrogenous matter, and its presence carries this significance. Nitrate concentration is of particular interest in relation to the other forms of nitrogen that may be present in the sample. Nitrates occur in the crust of the earth in many places and are a source of its fertility.

Phosphorus

Total Phosphorus - Total Phosphorus is a measure of both the organic and inorganic forms of phosphorus present.

Soluble Phosphorus - Soluble Phosphorus is a measure of the orthophosphate only and when subtracted from the total phosphorus gives an indication of the concentration of organic phosphorus present. That is, the soluble phosphorus is a measure of the inorganic phosphorus present, except the phosphorus in the form of polyphosphate, which however, in surface waters is usually insignificant. Inorganic phosphorus in concentration in excess of 0.01 ppm may cause nuisance conditions.

IMPLEMENTATION OF WATER AND SEWAGE WORKS PROGRAMS

Currently, there are three general methods which may be utilized for implementing sewage and water works programs. These are: 1) to enter into an agreement with the OWRC for the construction of the treatment and collector works with an obligation to pay the debt retirement and operating charges over the term of the agreement with the facility reverting to the municipality at the end of the term of the agreement, 2) by requesting the provision of service from a Provincially-owned project, and 3) by proceeding with the construction independently and meeting capital costs by the sale of debentures.

OWRC/MUNICIPAL PROJECTS

For the construction of water and sewage works under agreement with this Commission, the works are provided and developed under Sections 39 to 46 of the Ontario Water Resources Commission Act.

For this type of arrangement, the Commission utilizes a sinking fund and consequently the annual payments are based on a specific debt retirement period and the payments are unchanged for the period of the agreement. This type of project may be financed over a period of time up to a maximum of thirty years. The annual charges for projects constructed under this agreement are determined as follows:

1. Capital Repayment

As noted, OWRC financing is by the sinking fund method and an annual payment of approximately 2 per cent of the capital cost is required to retire a debt over a thirty-year period.

2. Interest

On new Commission projects, interest is calculated at the current rate.

3. Reserve Fund

To provide money for repairs and replacements, Section 40 of the Ontario Water Resources Commission Act provides for the establishment of a reserve fund by the Commission. It is important to note that this fund is established in the name of the municipality and the balance consequently earns interest. It has now been established by Commission minute that the reserve fund billing for each project shall continue only until the fund reaches an amount of ten times the initial annual billing and the reserve fund billing shall be re-imposed only when the fund has been depleted to 80 per cent or less of the maximum amount.

If the proposed works are to be built by the municipality on its own initiative or as a formal project under agreement with this Commission, it is required that the Council retain a consulting engineer to prepare preliminary engineering reports on the proposed work. If a Provincial system is contemplated, no action should be taken with respect to retaining a consulting engineering firm as the Commission will designate a consulting engineer to carry out the Provincial portion of the work and it would be advantageous if the municipal portion be studied and reported on by the same engineer.

standard type of Commission project. It would appear that where applicable, it would be more advantageous for the municipality to proceed on the basis of requesting this Commission to develop entire systems as Provincially-owned works.

The associated cost of supplying these works, including amortization of capital costs, together with operating and maintenance charges, will be recovered by the sale of service to the affected municipalities by rates determined on a usage basis. These facilities will be wholly-owned by the Province of Ontario and the arrangements for service will be formalized by contracts between the Commission and the municipality concerned. The installation will be operated entirely at cost with appropriate provision for adjustment in rate.

DEVELOPMENT

If a municipality, after considering the alternatives, wishes this Commission to consider Provincially-financed projects, application forms should be completed and submitted together with a resolution of the Municipal council. A draft of the suggested wording of the resoltuion is included with the application forms.

4. Operating Costs

Under OWRC agreement, the municipality is responsible only for the operating costs directly attributed to the project in the municipality. Therefore, no charges are made by the Commission for the services of head office personnel who are available as required to advise on the satisfactory operation and maintenance of the project.

PROVINCIALLY-OWNED PROJECTS

In June, 1967, the Honourable J.R. Simonett, Minister of Energy and Resources Management, made an announcement which expanded the authorization of this Commission for the provision of water supply and sewage treatment facilities. This new program allows the Commission to construct entire water and sewage works facilities for small municipalities. The capital costs of these can be amortized over a 40-year period.

A slight variation of this program could be implemented in that the municipality may request that this Commission provide only the major water and sewage works facilities as Provincially-owned works, and develop the water distribution and sewage collector systems under the

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ONTARIO WATER RESOURCES COMMISSION

TOWN OF GRAVENHURST (URBAN AREA)

WATER POLLUTION SURVEY 1971

SCALE: 100 0 200 400 600 FEET (APPROX.)	
DRAWN BY: A.R.S.	DATE: JUNE, 1971
CHECKED BY:	DRAWING No: 71-45-DE

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